

AMENDMENTS TO THE CLAIMS

1. (Previously Presented) A communication device, which uses turbo codes as error-correction codes, comprising:

a transmitter that includes a turbo encoding unit which carries out a turbo encoding process on a predetermined number of lower bits in transmission data and outputs information bits corresponding to the lower bits and first and second redundant bits that have been convolutionally encoded in different sequences, wherein the transmitter transmits the output of the turbo encoding unit and upper bits of the transmission data; and

a receiver that includes:

a first decoding unit which extracts the information bits and the first redundant bit from a received signal, and makes a soft-judgment on the lower bits based upon either the results of the extraction and a previous soft judgment output or only the results of the extraction;

a second decoding unit which extracts the information bits and the second redundant bits from the received signal, makes a soft-judgment on the lower bits based upon the results of the extraction and the soft-judgment output from said first decoding unit, and informs said first decoding unit of the result of the soft-judgment as the previous soft-judgment output;

a first judging unit which makes a hard-judgment on the lower bits based upon the soft-judgment output of said second decoding unit after the first and a second judging unit execute the soft-judgment repeatedly; and

a second judging unit which makes a hard-judgment on the upper bits of the transmission data based upon the received signal.

2. (original) The communication device according to claim 1, wherein said turbo encoding unit includes a deinterleave processing unit for carrying out a de-interleaving process on one group of the redundant bits that have been encoded after the interleave process to output the respective information bits and the redundant bits with the times being coincident with each other.

3. (original) The communication device according to claim 1, wherein Reed Solomon codes and turbo codes are used combinedly, and on the transmitting side, the turbo encoding is carried out after the Reed Solomon encoding, while on the receiving side, the Reed Solomon codes are decoded after decoding the turbo codes.

4. (Previously Presented) A communication device comprising an encoder that uses turbo codes with an interleave process being incorporated into an encoding process, and outputs results of the encoding process,

said encoder includes,

a turbo encoding unit which receives transmission data constituted by a plurality of bits, and carries out a turbo encoding process on a predetermined number of lower bits in the transmission data to output information bits in accordance with the predetermined number, including a first redundant bit being obtained by convolutionally encoding the information bits and a second redundant bit being obtained by convolutionally encoding the information bits after the interleave process; and

a computing unit which carries out calculations for uniforming error-correction capabilities on the respective information bits by using the information bits and the redundant bits,

wherein the results of the calculations and upper bits in the transmission data are outputted as the results of the encoding process.

5. (original) The communication device according to claim 4, wherein said turbo encoding unit includes a deinterleave processing unit which carries out a de-interleaving process on the second redundant bits,

wherein the respective information bits, the first redundant bits and the second redundant bits that have been subjected to the

de-interleaving process are outputted with the times being coincident with each other.

6. (original) The communication device according to claim 4, wherein Reed Solomon codes and turbo codes are used combinedly and the turbo encoding is carried out after the Reed Solomon encoding.

7. (Previously Presented) A communication device comprising an encoder that uses turbo codes with an interleave process being incorporated into an encoding process, and outputs results of the encoding process,

said encoder includes a turbo encoding unit which receives transmission data constituted by a plurality of bits, and carries out a turbo encoding process on a predetermined number of lower bits in the transmission data, and outputs information bits corresponding to the lower bits, a first and a second redundant bit, the first redundant bit being obtained by convolutionally encoding the information bits, and the second redundant bit being obtained by convolutionally encoding the information bits after the interleave process,

wherein, in addition to the respective information bits and the first and the second redundant bits, upper bits in the transmission data are outputted as the results of the encoding process.

8. (original) The communication device according to claim 7, wherein Reed Solomon codes and turbo codes are used combinedly and the turbo encoding is carried out after the Reed Solomon encoding.

9. (Currently Amended) A communication device comprising a decoder that decodes a received signal, the received signal comprising information bits and a first and a second redundant bit encoded based upon a predetermined number of lower bits of transmission data,

said decoder including,

a first decoding unit which makes a soft-judgment on the information bit based upon the received signal and a previous soft-judgment output;

a second decoding unit which makes a soft-judgment based upon the received signal and the soft-judgment output from said first decoding unit, and informs said first decoding unit of the results of the soft-judgment as the previous soft-judgment output;

a first judging unit which estimates the lower bits of the transmission data based upon the soft-judgment output of said second decoding unit after the first and a second judging unit execute the soft-judgment; and

a second judging unit which makes a hard-judgment on upper bits of the transmission data based upon a plurality of bits in the

received signal corresponding to the upper bits of the transmission data.

10. (original) The communication device according to claim 9, wherein, when Reed Solomon codes and turbo codes are used combinedly on the transmitting side, the Reed Solomon codes are decoded after decoding the turbo codes.

11. (Previously Presented) A communication method, which uses turbo codes as error-correction codes, the method comprising:

a transmitting step that includes:

a turbo encoding step of carrying out a turbo encoding process on a predetermined number of lower bits in transmission data and outputs information bits corresponding to the lower bits and a first and second redundant bit convolutionally encoded in different sequences; and

a receiving step that includes:

a first decoding step of extracting the information bits and the first redundant bit from a received signal and making a soft-judgment based upon either the results of the extraction and a previous soft judgment output;

a second decoding step of extracting the information bits and the second redundant bit from the received signal and making a soft-judgment based upon the results of the extraction

and a soft-judgment output from the first decoding step, thereby generating the results of the soft-judgment as the previous soft-judgment output;

a first judging step of estimating the lower bits of the transmission data based upon the result of the soft-judgment generated in the second decoding step; and

a second judging step of making a hard-judgment on the upper bits of the transmission data based upon the received signal.

12. (original) The communication method according to claim 11, wherein the turbo encoding step includes a deinterleave processing step of carrying out a de-interleaving process on one group of the redundant bits that have been encoded after the interleave process,

wherein the respective information bits and the redundant bits are outputted with the times being coincident with each other.

13. (original) The communication method according to claim 11, wherein Reed Solomon codes and turbo codes are used combinedly, and on the transmitting side, the turbo encoding is carried out after the Reed Solomon encoding, while on the receiving side, the Reed Solomon codes are decoded after decoding the turbo codes.

14. (Previously Presented) The communication device according to

claim 1, further comprising a computing unit which carries out calculations for uniforming error-correction capabilities on the respective information bits by using the information bits corresponding to the lower bits and the redundant bits, wherein the transmitter transmits the upper bits of the transmission data and transmits the results of the calculations by the computing unit as the output.

15. (Previously Presented) The communication method according to claim 11, further including a computing step of carrying out calculations for uniforming error-correction capabilities on the respective information bits by using the information bits corresponding to the lower bits and the redundant bits, wherein, in the transmission step, the upper bits of the transmission data and the results of the calculations at the computing step are transmitted as the results of the turbo encoding step.